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GINNING OF NARROW-ROW COTTON

Production Research Report No. 160

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GINNING OF NARROW-ROW COTTON

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ABSTRACT

Ginning studies were conducted to compare the cleaning performance of six stripper-type cotton varieties produced in both narrow rows and conventional 40-inch rows. Three varieties were those normally planted in 40-inch rows, and three were new varieties specifically developed for narrow-row production. These varieties were selected to provide a suitable range of plant characteristics for determining the effects of row spacing on cleaning requirements at the gin.

The results indicated that no additional cleaning equipment was required to satisfactorily gin the narrow-row, stripper-type cotton. The stick content of the narrow-row cotton tended to be lower, sometimes substantially lower, than of the cotton produced in 40-inch rows. The lower stick content of narrow-row cotton tends to relieve some of the pressure on existing stick-extraction equipment at gin. Therefore, dominant narrow-row production may eliminate the need for additional extraction equipment in the future. Gins that presently have adequate cleaning equipment for processing conventionally produced cotton can also satisfactorily gin narrow-row cotton.

INTRODUCTION

The term "narrow-row cotton" generally refers to cotton planted in rows spaced less than 40 inches apart. Most narrow-row cotton is planted in single rows spaced 10 to 20 inches apart or on beds spaced 40 inches apart, with two rows per bed.

The existing possibilities for improving fiber quality and reducing production costs are responsible for the interest in narrow-row cotton production. High plant populations in narrow rows can improve fiber quality by pro-

ducing the crop faster. This capability is especially important on the Texas High Plains, where the growing season is short and late season temperatures are usually unfavorable for fiber development. Reductions in production costs are also possible because less labor and fewer cultivations are required.

Cotton planted in narrow rows comprises about 2 percent (50,000 acres) of the cotton acreage on the Texas High Plains. Research has shown that narrow-row production of standard cotton vari-

eties under irrigation will average 8 to 10 percent more cotton than 40-inch rows.¹ New cotton varieties developed specifically for narrow-row planting will potentially perform better in narrow rows than the varieties being utilized for this purpose.

Two factors in narrow-row production may necessitate some modifications in the ginning process used for conventionally grown cotton: (1) A different type of stripper harvester is used in narrow-row cotton production. (2) The new cotton varieties being developed differ considerably in plant type from present varieties.

The stripper used in narrow-row cotton production has fixed fingers, rather than revolving rolls, that remove the bolls from the plant, including some leaves and stems. Unless the cotton plant is small, the finger stripper will harvest a greater quantity of extraneous plant material than the conventional roll stripper. Thus, plant size may have a greater effect on the total trash content of narrow-row cotton than on conventionally planted cotton.

The varieties being developed for narrow-row production are faster maturing and smaller than conventional varieties. The in-

fluence of narrow-row production and these new varieties on ginning performance needs evaluation under various growing conditions.

Ginning studies were conducted in 1971 and 1972 at Agricultural Research Service's South Plains Ginning Research Laboratory, Lubbock, Tex., to compare the cleaning performance of six stripper-type cotton varieties produced in both narrow rows and conventional 40-inch rows. Three of the varieties were those normally planted in 40-inch rows and three were new varieties specifically developed for narrow-row production. These varieties were selected to provide a suitable range of plant characteristics for determining the effects of row spacing on cleaning requirements at the gin.

1971 STUDY Procedure

The varieties 'Paymaster Dwarf' and 'Dunn 56C', planted May 8, 1971, were grown in 40-inch and 10-inch rows under three moisture regimes at the Texas Agricultural Experiment Station, Lubbock.² 'Dunn 56C' was developed for conventional planting, and 'Paymaster Dwarf' was developed specifically for narrow-row production. The following moisture regimes were imposed: (M1) One irrigation at peak bloom, (M2) irrigation at first

¹Brashears, A. D., Kirk, I. W., and Hudspeth, E. B. 1968. Effects of row spacing and plant population on double-row cotton. *Tex. Agric. Exp. Stn. Bull.* MP-872, 7 pp. Wanjura, D. F., and Hudspeth, E. B. 1963. Effects of close-row spacing on cotton yields on the Texas High Plains. *Tex. Agric. Exp. Stn. Bull.* PR-2266, 3 pp.

²The 1971 study was funded by the Cooperative State Research Service (USDA).

bloom and thereafter when 60 percent of the soil moisture had been depleted, and (M3) irrigation at first square and thereafter when 40 percent of the soil moisture had been depleted. Harvest season weather was unfavorable, and harvesting was delayed until January 19, 1972, when a roll stripper was used on the 40-inch rows and a finger stripper on the 10-inch rows.

Soil moisture levels were used as replications within row spac-

ings and varieties in the ginning test. The gin machinery sequence consisted of an air-line cleaner, automatic feed control, tower drier, inclined cleaner, bur machine, tower drier, inclined cleaner, stick machine, extractor feeder, gin stand, two lint cleaners, and a press.

Results

The foreign matter content of 'Paymaster Dwarf' and 'Dunn 56C' is presented in table 1. With-

TABLE 1. — Foreign matter content of 'Paymaster Dwarf' and 'Dunn 56C' as influenced by row spacing, 1971¹
[Percent]

Row spacing and soil moisture level ¹	'Paymaster Dwarf'			'Dunn 56C'		
	Hulls	Sticks	Fine trash	Hulls	Sticks	Fine trash
Samples taken from wagon ²						
10-inch rows:						
M1.....	25.94	4.93	6.56	21.79	8.98	6.26
M2.....	24.62	6.08	6.46	23.14	8.59	6.87
M3.....	26.24	5.53	5.98	24.79	8.72	6.36
Mean.....	25.6a	5.5a	6.3a	23.2a	8.7a	6.5a
40-inch rows:						
M1.....	27.07	4.58	5.93	22.28	9.28	4.94
M2.....	28.77	8.58	4.56	22.14	11.57	5.55
M3.....	23.90	8.82	5.48	25.54	12.61	5.37
Mean.....	26.6a	7.3a	5.3a	23.3a	11.2a	5.3b
Samples taken from feeder apron ²						
10-inch rows:						
M1.....	1.68	0.78	3.94	3.80	1.75	3.02
M2.....	2.35	1.41	4.41	4.91	3.26	4.55
M3.....	2.36	1.86	4.54	5.28	1.81	7.13
Mean.....	2.1a	1.4a	4.3a	4.7a	2.3a	4.9a
40-inch rows:						
M1.....	2.24	1.17	1.65	5.18	2.29	3.37
M2.....	2.12	1.49	3.73	4.32	3.28	5.71
M3.....	2.67	2.02	5.51	4.62	4.33	5.86
Mean.....	2.3a	1.6a	3.6a	4.7a	3.3a	5.0a

¹ The entry for each soil moisture level is the average of 3 samples. M1 One irrigation at peak bloom. M2 Irrigation at first bloom and thereafter when 60 pct of soil moisture had been depleted. M3 Irrigation at first square and thereafter when 40 pct of soil moisture had been depleted.

² Means in the same column followed by a common letter are not statistically different at the 0.05 level.

in each variety, row spacing had little influence on the foreign matter content of cotton on the wagon. However, the 40-inch rows of 'Dunn 56C' had significantly less fine trash than the 10-inch rows. At the feeder apron, foreign matter components were not significantly different within each variety, but 'Paymaster Dwarf' was consistently cleaner than 'Dunn 56C' in all components.

After lint cleaning, grade indices between row spacings were not statistically different within each variety (table 2). All 'Dunn 56C' samples were reduced in grade because of excessive bark. However, grade index consistently improved with lint cleaning at each soil moisture level within a row spacing.

Two trends are evident for grade index in 'Paymaster Dwarf'. Before and after lint cleaning, the number of samples having excessive bark increased for each row spacing as the soil moisture level increased. Lint cleaning improved the mean grade index for each row spacing and reduced the number of samples having excessive bark. Before lint cleaning, four 'Paymaster Dwarf' samples from the 10-inch rows had excessive bark, as compared to eight from the 40-inch rows.

The stick content of seed cotton entering the gin is generally believed to effect the amount of bark in the lint. The lowest stick content of 'Paymaster Dwarf' was 0.78 percent, and a 1.17-percent stick content produced bark-free lint. Stick contents as low as 1.41

TABLE 2. — *Grade index before and after two stages of lint cleaning for 'Paymaster Dwarf' and 'Dunn 56C' as influenced by row spacing, 1971¹*

Row spacing and soil moisture level ²	'Paymaster Dwarf'	'Dunn 56'
Before lint cleaning ³		
10-inch rows:		
M1.....	80	72***
M2.....	77*	76***
M3.....	76***	76***
Mean.....	77a	74.7a
40-inch rows		
M1.....	79**	76***
M2.....	76***	60***
M3.....	76***	63***
Mean.....	77a	66.3a
After lint cleaning ³		
10-inch rows:		
M1.....	94	85***
M2.....	92*	85***
M3.....	89***	86***
Mean.....	92a	85a
40-inch rows:		
M1.....	94	85***
M2.....	89**	86***
M3.....	88**	85***
Mean.....	90a	85a

¹ Grade index provides a method for averaging the grade of a number of samples. Middling grade is assigned a value of 100, and lower index numbers reflect lower grades.

² See footnote 1 to table 1.

³ Means in the same column for the same amount of lint cleaning followed by a common letter are statistically the same at the 0.05 level. 1, 2, or 3 asterisks after grade index number indicate 1, 2, or 3 samples were reduced in grade because of excessive bark. Absence of asterisks indicates no samples were reduced in grade because of excessive bark.

percent had at least one sample with high bark content, and stick contents of 1.86 percent or more

had high bark contents in at least two of three samples. The lowest stick content for 'Dunn 56C' entering the gin stand was 1.75 percent, and all the samples had high bark contents. The effect of sticks on the bark content of cotton entering the gin was generally consistent between varieties and row spacings. Since 'Dunn 56C' had consistently higher stick content in both row spacings than 'Paymaster Dwarf', variety influenced the bark content of the lint more than row spacing.

Fiber property measurements were made by Texas Tech University's Textile Research Center at Lubbock, and moisture measurements were made from bur cotton on the wagon (table 3). 'Dunn 56C' in the 40-inch rows had slightly lower length uniformity and higher nonlint content than in the 10-inch rows. After two lint cleanings, 'Paymaster Dwarf' showed no differences in fiber

properties between lint produced in the 10- and 40-inch rows.

On the wagon, the trash content of cotton grown in the 10-inch rows tended to be lower, but the differences between the 10- and 40-inch rows were not statistically significant (table 1). The problem of excessive bark caused by high stick content in bur cotton was less severe in the 10-inch rows. These results indicate that gins adequately equipped to clean conventionally grown cotton can also satisfactorily gin narrow-row cotton.

1972 STUDY

Procedure

Four varieties of cotton produced in 16-inch and 40-inch rows were used for this study. Two of the varieties, 'Broadcot 31' and 'Earlycot 31', were specifically developed for narrow-row production. The other two varieties, 'Lockett 4789A' and 'Stripper 31',

TABLE 3. — *Moisture content and fiber properties of 'Paymaster Dwarf' and 'Dunn 56C' as influenced by row spacing, 1971¹*

Measurement	'Paymaster Dwarf'		'Dunn 56C'	
	10-inch	40-inch	10-inch	40-inch
Bur-cotton moisture content on wagon.....pct	7.19a	7.09a	6.86a	7.29a
Nonlint content:				
Before lint cleaning.....pct	9.62a	9.30b	11.32b	13.64a
After lint cleaning.....pct	3.64a	3.60a	4.01b	4.63a
Staple length.....32d inch	31.7a	31.6a	33.6a	33.3a
Micronaire reading.....	3.1a	3.1a	3.1a	2.8a
Stelometer strength.....g/tex	19.8a	19.8a	22.6a	23.5a
2.5-pet span length.....inch	0.95a	0.96a	1.04a	1.02a
Length uniformity.....pct	42.3a	42.6a	42.0a	41.3b

¹ Means for the same variety in a row followed by a common letter are not statistically different at the 0.05 level.

were conventional stripper-type varieties widely produced on the Texas High Plains. These conventional varieties mature earlier than most varieties and for this reason are better suited for narrow-row production.

The cotton was planted May 26, 1972, as part of a variety demonstration trial conducted by the Texas Agricultural Extension Service on a commercial farm near Wolfforth, Tex. Adverse weather at planting, poor seed germination, and hail damage 2 months after planting reduced plant yields and caused lint quality to be abnormally low.

A conventional roll stripper was used to harvest the 40-inch-row cotton, and a finger stripper was used for the 16-inch-row cotton. At harvest, the 16-inch-row cotton was approximately 18 inches tall, and the 40-inch rows were about 36 inches tall.

All four test varieties were processed in random order through the machinery sequence used in the 1971 study.

Results

The average moisture content of bur cotton on the wagon ranged from 8.5 to 10.2 percent (table 4). 'Broadcot 31' and 'Stripper 31' produced in 16-inch rows initially had slightly higher moisture content than the other two test varieties. The lint moisture content (measured by an electronic moisture meter) at the feeder apron ranged from 5.8 to 6.3 percent. Lint moisture content

at the press ranged from 5.4 to 5.6 percent. Differences in lint moisture content, at the feeder apron and at the press, were not significant among varieties or between row spacings.

Within each variety, on-the-wagon cotton produced in 16-inch rows contained higher percentages of burs and fine trash than the 40-inch-row cotton. However, the stick content of the 16-inch rows was considerably lower than that of the 40-inch rows for all varieties. The ranges in average stick content of the 16-inch and 40-inch rows were 2.9 to 4.6 percent and 9.7 to 11.8 percent, respectively. Bur content, which was highest for 'Lockett 4789A', was approximately equal for the other varieties.

There were significant differences at the feeder apron in stick content between the two row spacings of the test varieties. The 40-inch-row cotton contained 0.5 to 2.0 percentage points more sticks than the 16-inch-row cotton. There were no significant differences in bur or fine-trash content between the two row spacings. There were, however, differences in bur and fine-trash content among the four varieties. 'Broadcot 31' and 'Earlycot 31' contained more burs than the conventional varieties. Fine-trash content was highest for 'Lockett 4789A' and lowest for 'Stripper 31'.

Row spacing had no significant effect on nonlint content before or after lint cleaning. 'Stripper 31' was slightly cleaner than the

TABLE 4. — *Moisture content, fiber properties, and foreign matter content of 'Broadcot 31', 'Earlycot 31', 'Lockett 4789A', and 'Stripper 31' as influenced by row spacing, 1972*¹

Measurement	'Broadcot 31'		'Earlycot 31'		'Lockett 4789A'		'Stripper 31'	
	16-inch	40-inch	16-inch	40-inch	16-inch	40-inch	16-inch	40-inch
Moisture content:								
Bur cotton, wagon	10.2c	8.8a	8.7a	8.6a	9.3ab	9.3ab	9.9b	8.5ab
Lint, feeder apron	6.2a	6.3a	6.2a	6.2a	6.0a	6.0a	6.2a	6.2a
Lint, press	5.4a	5.5a	5.5a	5.4a	5.6a	5.6a	5.5a	5.4a
Foreign matter content on wagon:								
Burs	26.6cd	24.5ab	25.9bc	24.9ab	28.6e	26.5cd	27.9de	23.4a
Sticks	4.6a	10.2bc	4.1a	9.7b	2.9a	11.8c	4.3a	9.7b
Fine trash	5.2b	4.1a	5.4b	4.2a	4.8b	4.0a	5.0b	3.8a
Total	36.4a	38.8b	35.4a	38.8b	36.3a	42.3c	37.2ab	36.9ab
Foreign matter content at feeder apron:								
Burs	4.6c	4.6c	5.1c	5.4c	3.2b	3.0ab	2.8ab	2.1a
Sticks	2.1ab	2.6b	1.8a	3.0b	1.2a	3.2b	1.5a	2.2b
Fine trash	4.2b	4.0b	3.8ab	4.2c	4.8c	4.2b	3.9ab	3.5a
Total	10.9c	11.2c	10.7c	12.6d	9.2ab	10.4bc	8.2a	7.8a
Nonlint content:								
Before lint cleaning	13.2b	12.8b	13.2b	13.2b	13.0b	13.7b	11.7a	11.0a
After lint cleaning	4.1b	4.3bc	4.2bc	4.3bc	4.5bc	4.7c	4.2bc	3.6a
Grade index	93a	94a	94a	92a	92a	92a	93a	94a
Staple length	30.7a	30.7a	31.3a	30.9a	31.3a	31.1a	30.7a	31.2a
Micronaire reading	2.5a	2.5a	2.6a	2.5a	(2)	(2)	2.6a	2.7a
Stelometer strength	21.8d	20.8bc	21.1c	21.2cd	21.3cd	21.1c	20.4ab	20.8bc
2.5-pct span length	0.89a	0.89a	0.88a	0.88a	0.92b	0.93b	0.88a	0.87a
Length uniformity	44b	44b	45b	44b	42a	42a	44b	45b

¹ Means in a row followed by a common letter are not statistically different at the 0.05 level.

² Micronaire reading less than 2.4.

other varieties, but this had little effect upon grade index. The average grade indices among the varieties ranged from 92 to 94 (approximately Strict Low Middling) and was not influenced by row spacing or variety. No samples were reduced in grade because of high bark content. The average staple lengths ranged from 30.7 to 31.3 (32d inch), and the micronaire readings ranged from less than 2.4 to 2.7. Row spacing had no measurable effect on staple length or Micronaire reading. Differences in Stelometer strength, 2.5-percent span length, and length uniformity were due to inherent varietal differences and

were not significantly influenced by row spacing.

These results indicate that the primary difference between 16-inch and 40-inch-row cotton is in stick removal requirements. Within each variety, the 16-inch rows contained substantially fewer sticks than the 40-inch rows. Existing stick-extraction equipment at commercial gins is often inadequate for cotton containing large amounts of sticks. From these results, it appears that narrow-row cotton would relieve some of the pressure on existing stick-extraction equipment and may eliminate the need for additional equipment in the future.

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